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EXAMINER	
LIEW, ALEX KOK SOON	

ART UNIT	PAPER NUMBER
2624	

NOTIFICATION DATE	DELIVERY MODE
08/20/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/681,007	CRIMINISI ET AL.	
	Examiner	Art Unit	
	ALEX LIEW	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 May 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-45* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

1. The amendment filed on 5/8/08 is entered and made of record.

2. Response to applicant's arguments:

I. On page 11, the applicant stated:

Roy does not anticipate "computing a minimum cost path in a stereo disparity model between a scan line of a first image and a corresponding scan line of a second image of a stereo image pair," "using a three-layer graph for dynamic programming," or "distinguishing between non-fronto-parallel matched pixels in each scan line and occluded pixels in each scan line." Accordingly, claim 1 is allowable over the cited reference and the rejection should be withdrawn.

The examiner agrees where Roy does not disclose 'using a three-layer graph for dynamic programming.' Buhrke (US pat no 6,006,181) discloses using a three-layer graph for dynamic programming (see figure 2 and column 3, lines 54-57). One skilled in the art would include dynamic programming because to allow building object pattern models to be match, to improve recognition of the object in the image.

II. On page 11, applicant stated:

Non-fronto-parallel pixels, however, refer to a surface that is substantially parallel to an axis connecting the left and right cameras. (p. 5, lines 16-18). Roy does not anticipate "distinguishing between non-fronto-parallel matched pixels in each scan line and occluded pixels in each scan line."

The examiner does not agree; there is no where in claim 1, which cites 'substantially parallel to an axis connecting the left and right camera.' The term 'non-fronto-parallel' will be read as broad as possible.

III. Page 10, the applicant stated:

Roy, however, discusses using maximum-flow estimation without concern for epipolar lines. (Col. 1 lines 49-52, Emphasis added).
Roy uses maximum-flow analysis rather than minimum cost analysis. While these two approaches may end with the same result in some circumstances, they are not the same. Costs may not always equate to flow capabilities. Focusing on one approach rather than the other may lead to differing optimizations. Roy does not teach computing a minimum cost path.

The examiner disagrees; on column 4, lines 61-66 of Roy, discusses obtaining the minimum path by matching all the epipolar lines.

Roy also discloses computing a minimum cost path in a stereo disparity model between a scan line of a first image and a corresponding scan line of a second image of a stereo image pair (see figure 1, the left diagram shows two axis, horizontal axis being line from the first image and vertical axis being line from the second image, discussed on column 4 lines 43-47 and lines 61-66), the stereo disparity model distinguishing between non-fronto-parallel matched pixels in each scan line and occluded pixels in each scan line (see column 5 lines 43-67, reg(u,v) is reads as the non-fronto-parallel pixels and occ(u,v) is read as the occluded pixels).

The combination of Roy and Buhrke disclose the invention of claim 1.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 2, 4, 5, 16, 17, 19, 20, 31,32, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roy (US pat no 6,046,763) in view of Buhrke (US pat no 6,006,181).

With regards to claim 1, Roy reads on a method comprising: computing a minimum cost path in a stereo disparity model between a scan line of a first image and a corresponding scan line of a second image of a stereo image pair (see figure 1, the left diagram shows two axis, horizontal axis being line from the first image and vertical axis being line from the second image, discussed on column 4 lines 43 to 47 and lines 61-66), the stereo disparity model distinguishing between non-fronto-parallel matched pixels in each scan line and occluded pixels in each scan line (see column 5 lines 43 to 67, reg(u,v) is reads as the non-fronto-parallel pixels and occ(u,v) is read as the occluded pixels).

Roy does not disclose 'using a three-layer graph for dynamic programming.' Buhrke discloses using a three-layer graph for dynamic programming (see figure 2 and column 3, lines 54-57). One skilled in the art would include dynamic programming because to allow building object pattern models to be match, to improve recognition of the object in the image.

With regards to claim 2, Roy reads on a method of claim 1, wherein the computing operation comprises computing matching costs for each pixel of each scan line pair (see figure 13, element 1340, the depth map is computed for the entire image, which includes every lines in the images).

With regards to claim 4, Roy reads on a method of claim 1, wherein the computing operation comprises altering the matching costs for at least one pixel pair based on whether the pixel pair is determined to be associated with a non-fronto-parallel surface or an occlusion (see column 7, lines 34 to 40).

With regards to claim 5, Roy reads on a method of claim 1, wherein the computing operation comprises determining a minimum cost path in the stereo disparity model (see equation on column 5, lines 45 to 53, is a disparity model).

With regards to claims 16 and 31, see the rationale and rejection for claim 1.

With regards to claims 17 and 32, see the rationale and rejection for claim 2.

With regards to claims 19 and 34, see the rationale and rejection for claim 4.

With regards to claims 20 and 35, see the rationale and rejection for claim 1.

3. Claims 3, 18 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roy ('763) in view of Buhrke ('181) as applied to claim 1, further in view of Chupeau (US pat no 5,727,078).

With regards to claim 3, Roy and Buhrke disclose all the limitations in claim 1, but do not disclose computing matching costs for each pixel of each scan line pair using a windowed matching cost function. Chupeau discloses computing matching costs for each pixel of each scan line pair using a windowed matching cost function (see column 6, lines 20 to 27). One skilled in the art would include windowed matching cost function because to located the desired object in the image in the pair stereo images, to compute the disparity and depth of the object; this leads to computing the three dimensional image of the object which gives more details.

With regards to claims 18 and 33, see the rationale and rejection for claim 3.

4. Claims 6 – 10, 21 – 25 and 36 - 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roy ('763) in view of Buhrke ('181) as applied to claim 1 further in view of Usami (US pat no 4,982,438).

With regards to claims 6 to 8, Roy and Buhrke disclose all the limitations discussed in claim 1, but do not disclose applying a cost penalty to move from an occluded pixel pair to a matched pixel pair.

However, Roy suggests, treating occlusion pixels by changing the edge capacities specific to a different match, such as matching any set of pixels to another set of occlusion pixels or non-occlusion pixels (see column 7, lines 36 to 39, the change in the edge capacities reads on applying a cost penalty). Usami discloses plurality of penalty costs (see figure 12a, S1, S7, S13, S19, S25, are the plurality of penalty; also see column 8, lines 31 to 37).

One skilled in the art would include applying a cost penalty because to determine if the current pixel matches with a background pixel or foreground pixel, which improves on matching method to create a more accurate stereoscopic image.

With regards to claim 9, Roy and Buhrke disclose all the limitations in claim 1, but do not discloses applying second penalty cost. Usami discloses applying a first cost penalty to a move from an occluded pixel pair to another occluded pixel pair (see figure 12A, S13 is the first cost penalty; also see column 8, lines 31 to 37); and applying a second cost penalty to a move from a matched pixel pair to an occluded pixel pair, the first cost penalty being different than the second cost penalty (see figure 12A, S1 is the first cost penalty; also see column 8, lines 31 to 37, S1 and S13 are located at different nodes). One skilled in the art would include applying a cost penalty because to determine if the current pixel matches with a background pixel or foreground pixel, which improves on matching method to create a more accurate stereoscopic image.

With regards to claim 10, Roy and Buhrke disclose all the limitations in claim 1, but do not discloses applying second penalty cost. Usami discloses applying a first cost penalty to a move from an occluded pixel pair to another occluded pixel pair (see figure 12A, S13 is the first cost penalty; also see column 8, lines 31 to 37); and applying a second cost penalty to a move from a matched pixel pair to an occluded pixel pair, the first cost penalty is less than the second cost penalty (see figure 12A, S1 is the first cost penalty; also see column 8, lines 31 to 37, S1 and S13 are located at different nodes, S1 being the older path). One skilled in the art would include applying a cost penalty because to determine if the current pixel matches with a background pixel or foreground pixel, which improves on matching method to create a more accurate stereoscopic image.

With regards to claims 21 – 23 and 36 – 38, see the rationale and rejection for claims 6 – 8.

With regards to claims 24, 25, 39 and 40, see the rationale and rejection for claims 9 and 10.

5. Claims 11, 12, 14, 15, 26, 27, 29, 30, 41, 42, 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roy ('763) in view of Buhrke ('181) as applied to claim 1, further in view of Chen (US pat no 6,556,704).

With regards to claim 11, Roy and Buhrke disclose all the limitations discussed in claim 1, and also discloses a disparity of the corresponding pixels being characterized by a minimum cost path of the stereo disparity model (see equation on column 5, lines 45 to 53, is a disparity model), but do not disclose computing a cyclopean virtual image. Chen discloses computing a cyclopean virtual image scan line based on corresponding pixels of scan lines of the first and second images (see figure 1, element 13a and 13b are the first and second image, respectively, and the depth map, 10, is read as the virtual image). One skilled in the art would include computing a cyclopean virtual image because to create a three-dimensional image, where this three-dimensional image shows more details on the object in the image, which improves recognition of the object in the image.

With regards to claim 12, Roy and Buhrke disclose all the limitations discussed in claim 1, but do not disclose computing a cyclopean virtual image. Chen discloses computing a cyclopean virtual image scan line based on corresponding pixels of scan lines of the first and second images (see figure 1, element 13a and 13b are the first and second image, respectively, and the depth map, 10, is read as the virtual image), wherein corresponding pixels that are matched are projected as a virtual pixel onto cyclopean virtual image scan line (see figure 1, the depth map are the result from first and second images' projection). One skilled in the art would include computing a cyclopean virtual image because to create a three-dimensional image, where this three-dimensional

image shows more details on the object in the image, which improves recognition of the object in the image.

With regards to claim 14, Roy and Buhrke disclose all the limitations discussed in claim 1, but do not disclose computing a cyclopean virtual image. Chen discloses computing a cyclopean virtual image scan line based on corresponding pixels of scan lines of the first and second images (see figure 1, element 13a and 13b are the first and second image, respectively, and the depth map, 10, is read as the virtual image), wherein a non-occluded pixel of an occluded pair of corresponding pixels is projected as a virtual pixel onto the cyclopean virtual image scan line from a background disparity in the stereo disparity model (see figure 1, the top and bottom image contains occluded pixels, read as the person in the image, and non-occluded pixels, read as the foreground; both images are matched using disparity method and the projected depth image is shown in the depth image, which is read as virtual image). One skilled in the art would include computing a cyclopean virtual image because to create a three-dimensional image, where this three-dimensional image shows more details on the object in the image, which improves recognition of the object in the image.

With regards to claim 15, Roy and Buhrke disclose all the limitations discussed in claim 1, but do not disclose computing a cyclopean virtual image. Chen discloses computing a cyclopean virtual image scan line based on corresponding pixels of scan lines of the first and second images (see figure 1, element 13a and 13b are the first and second

image, respectively, and the depth map, 10, is read as the virtual image), wherein a value of a non-occlusion pixel of an occluded pair of corresponding pixels is selected as a value of a resulting virtual pixel on the cyclopean virtual image scan line (see figure 1, the occluded pixels are those that belong to the object image and non-occluded pixel belongs to the background; both the top and bottom images are use to generating the depth image, which is read as the virtual image). One skilled in the art would include computing a cyclopean virtual image because to create a three-dimensional image, where this three-dimensional image shows more details on the object in the image, which improves recognition of the object in the image.

With regards to claims 26 and 41, see the rationale and rejection for claims 11.

With regards to claims 27 and 42, see the rationale and rejection for claims 12.

With regards to claims 29 and 44, see the rationale and rejection for claims 14.

With regards to claims 30 and 45, see the rationale and rejection for claims 15.

6. Claims 13, 28 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roy ('763) in view of Buhrke ('181) as applied to claim 1, further in view of Anandan (US pat no 6,198,852).

With regards to claim 13, Roy and Buhrke disclose all the limitations discussed in claim 1, but do not disclose averaging pixels to obtain virtual pixels. Anandan discloses computing a cyclopean virtual image scan line based on corresponding pixels of the scan lines of the first and second images (see figure 10, element 1070 is read as the virtual image, and see figure 5 and figure 6, are the first and second images), wherein corresponding pixels that are averaged to determined a value of a resulting virtual pixel on the cyclopean virtual image scan line (see column 18, lines 63 to 66). One skilled in the art would include averaging pixels to obtain virtual pixels because to obtain a value closest to the actual value, improving the three-dimensional generation of the object in the image.

With regards to claims 28 and 43 see the rationale and rejection for claim 13.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEX LIEW whose telephone number is (571)272-8623 or cell (917)763-1192. The examiner can be reached anytime.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C Bella/
Supervisory Patent Examiner, Art Unit 2624

Alex Liew

AU2624
8/15/08